CHAPTER 5
PRE-IETM DEVELOPMENT ISSUES

5.1 Introduction

Today's PMs face a dizzying array of issues when undertaking an IETM development program. Fortunately, processes exist which can assist the PM in determining the appropriate characteristics for the Program's IETMs. Two major processes (and resulting products), the Government Concept of Operations (GCO) and the IETM Concept of Operations (CONOPS), are addressed in this chapter.

5.2 GCO Development Process

The Defense Acquisition University has developed a GCO template, the GCO Generator, which is downloadable at http://www.acq.osd.mil/log/lro/toolkit/gco/gcointro.html, to provide a step-by-step tool that assists managers in selecting digital data for their defense systems. The GCO is a Government document used to provide information to potential offerors about the Government infrastructure and Integrated Data Environment (IDE) implementation strategy for defense systems.

The GCO planning process should start as early as possible in the acquisition process. This Government document is prepared during the acquisition planning stage for each procurement. Development of a GCO will help ensure that the Government can access or receive, via the IDE, the correct version and formats of digital data products needed to acquire and support a defense system.

The GCO can assist the Program Manager in determining:

a. Hardware and software systems the Government has, or is developing, to manage and use the data.
b. Data users, types of data, frequency of use, and timeliness of data access or delivery to each user.
c. Data use and the review/approval processes to support life-cycle functions.
d. User locations and their primary functions in support of the defense system.
e. Data interchange requirements including format, media, applicable standards, and existing telecommunications capabilities.
f. Access authorizations and restrictions.
g. Data acceptance requirements including data format, content, and the Government processes for accepting product data, processable data, or Contractor Integrated Technical Information Service (CITIS) data.

The GCO is developed by the Government acquisition team with input from other supporting Government activities involved in the life-cycle support of the defense system. The GCO should be included in the RFP (Section J) as Government Furnished Information (GFI).

5.3 About the Tool

The tool requires extensive input of program information dealing with the following:

- Program's supporting activities
- Data use and how it is used
- Infrastructure in place at each activity
- Activities' experience with the CALS standards and automated information systems

For a greater understanding of CALS, Joint Continuous Acquisition and Life-cycle Support (JCALS), and IDE, refer to Appendix B. This information can be analyzed by the software and used by the Program Manager to determine the requirements and data environment that will be described in the GCO. The GCO document is generated from a database of text based on actual GCOs, which is then tailored by the Program Manager to suit the program's requirements. The final output is either a digital or hard-copy version of the GCO document, including both the text and selected data tables.

The GCO Generator was originally developed in 1995 as a Navy software tool (version 1.0). The new version 2.0 is a DoD version that incorporates information from all of the services. Version 2.0 is not readily compatible with 1.0 because of many changes made to the GCO text database. Since a rewrite of the 1.0 version has been completed, any previously developed data should be regenerated with version 2.0 to produce the GCO text sections.

5.4 The GCO Process

The steps shown below are performed as part of the data collection, input, and analysis steps in the GCO Generator. This information is presented in MIL-HDBK-59B.

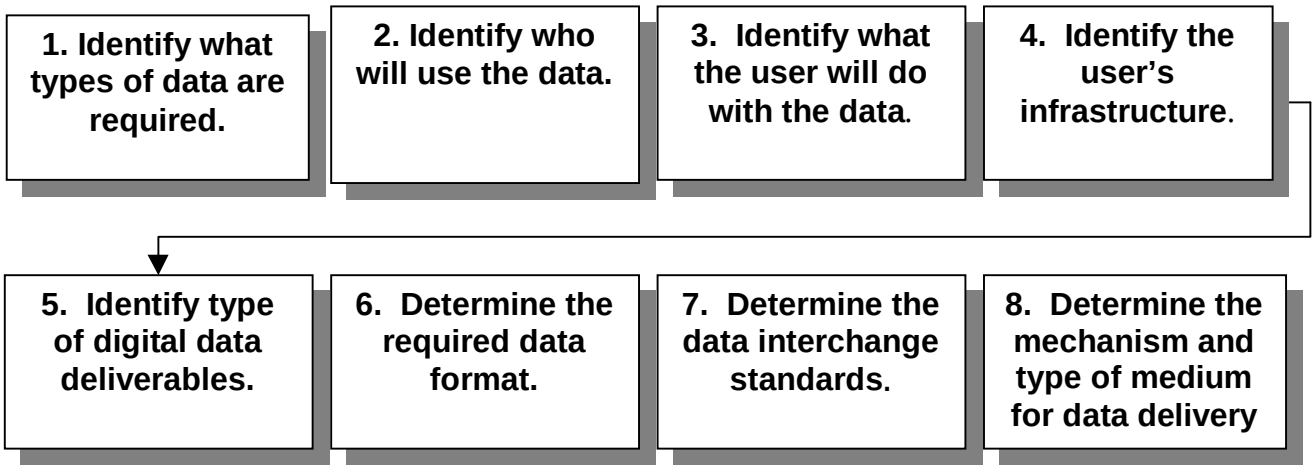

Figure 5-1. GCO Development Process

1. Identify what types of data are required
    - Product description data
    - Logistics plans and reports
    - Publications
    - Management and administrative data
2. Identify who will use the data
    - Management
    - Engineering/Design
    - Supply
    - Training
    - Manufacturing
    - Maintenance
3. Identify what the user will do with the data
    - View only
    - Comment/annotate
    - Update/maintain
    - Extract/process/ transform
    - Archive
4. Identify the user's infrastructure
    - Hardware
    - Software
    - Networks
5. Identify the type of digital data deliverables
    - Composed products
    - Processable data files
6. Determine the required data format
    - Document image file
    - Text file
    - Graphics file
    - Alphanumeric file
    - Audio/visual file
    - Integrated data file
7. Determine what data interchange standards are required
    - Document image standards
    - Text standards
    - Graphics standards
    - Application unique/data standards
8. Determine the mechanisms and type of media for data delivery/access
    - Hard-copy
    - Physical (magnetic tape, optical disk)
    - Online (CITIS)
    - Telecommunications (DISN, OSI, contractor specific)

5.5 Generator Process

This GCO Generator tool is designed to lead the Program Manager through the GCO development process, encompassing the following five steps:

- Data Collection. This step involves creation of a data collection survey that is distributed to supporting activities, preferably along with the normal data call information. This survey will gather information regarding the activities' infrastructure, data use requirements, IDE requirements, and experience with CALS standards and Automated Information Systems (AISs).

- Data Input. Once the surveys have been distributed, completed, and returned, all the data they contain is entered into a series of data tables. There is no requirement that data be entered into all the tables – only those that are needed by the program.

- Data Analysis. Data from the surveys is now analyzed to help determine the most common data formats and the overall experience with AISs (plus which ones to select for use by the program).

- CITIS Decision. Once the data has been analyzed, the Program Manager can determine whether or not and to what extent a CITIS should be implemented for the program.

- GCO Creation. After all the data is analyzed, writing the text of the GCO begins. The text contains five sections:

    1. Introduction

    2. CALS Implementation

    3. Data Requirements

    4. IDE Requirements

    5. IDE Infrastructure

After all these tasks are complete, the GCO Generator allows the preparer to view all the GCO text assembled on one form for final changes and then print the final, complete GCO.

5.6 Selection of IETM Functionality

Where the GCO assists the Program Manager in identifying the types (IETM, drawing packages, etc.) and the interchange standards (SGML, PDF) of digital deliverables, the IETM CONOPS assists the PM in determining IETM functionality. Therefore, after the decision to procure an IETM has been made, the IETM CONOPS should be developed. Whether acquiring new data or converting existing data for use in an IETM, the program must make key decisions in three areas:

a. Functionality - The features and capabilities that are desired to support users.
b. Standards - Government, commercial, performance or other specifications, standards, conventions, etc. that will be used to establish hardware/software interfaces and to ensure data neutrality, transportability, and survivability.

c. Data structure - The method for creating or assembling the data and effectively and affordably managing it throughout its life cycle.

Each decision acts as an enabler, facilitator, or constraint on other decisions. The selection of functionality has critical impact on:

- Cost and time required for conversion
- Functionality available to the users
- Costs and ability to maintain and update the data
- Ability to interface and interact with other data files
- Ability, cost, and effort to migrate to newer technology in the future.

5.7 Concept of Operations (CONOPS) Acquisition and Support Planning Process

The first step in defining IETM functionality is to develop an IETM CONOPS. It is vital that the PM team preparing this document the many interacting factors, assumptions, and considerations that formulate an implementation strategy. This is done in the IETM CONOPS, which establishes the conditions within and under which the IETM will function. Preparing the CONOPS should clarify issues and establish parameters to help a manager select optimal IETM functionality levels consistent with program requirements. If IETM development is to be contracted out, the CONOPS provides key information to the bidders.

Whether an IETM is being acquired as part of a new hardware system, or is being converted under contract, the resulting CONOPS will be referenced in the Request for Proposal (RFP), Statement of Work (SOW), Statement of Objectives (SOO), or Work Order -- along with the environment within which the IETM will be developed, fielded, and used. Additionally, the SOO/SOW should include other information as required to help bidders prepare their proposals and assist the program staff in evaluating the responses to required and desired functionality requirements.

The decision on the optimum class of IETM can result from the accumulation of information from all of the factors in the CONOPS or from any single factor (e.g. remaining service life, complexity of the system). The decision also may be made solely to satisfy external factors (such as direction from higher authority, required interface with other systems or manning). Consequently, the CONOPS is not intended to be a “score sheet” with a weighted quantitative value for each factor and a “right” answer. Instead, it provides a “check list” of items to be included in the deliberative process to ensure that the cognizant manager is assisted in selecting the highest level of automation and best class of IETM for his or her program. New conditions, such as changes in training philosophy, budget reductions, program phasing, evolving functionality requirements, emerging technologies, etc., may require that the CONOPS and its associated decisions be reviewed and changed.

5.8 Role of the CONOPS

The IETM CONOPS guides the program in identifying and projecting the characteristics of the hardware system (whether already in the field or in process of acquisition) which the IETM will support. (A sample CONOPS for the fictional "Sagittarius System" is included as Appendix H). This helps to define the functionality of the supporting IETM.

- The IETM CONOPS helps programs define/plan the processes required for the life-cycle support of the IETM. The IETM Functionality Determination Model (Figure 5-2) uses system attributes data to determine the functionality required to support the intended IETM users. Interplay between items in the CONOPS and the decisions of this model may result in a number of iterations before the plan is finalized.

- Completion of the CONOPS provides a tailored document that highlights processes, issues, and considerations related to the successful implementation of IETMs in both program and DoD terms. When complete, the CONOPS will provide a common structured document that describes the anticipated factors and environment that affect IETM development and use.

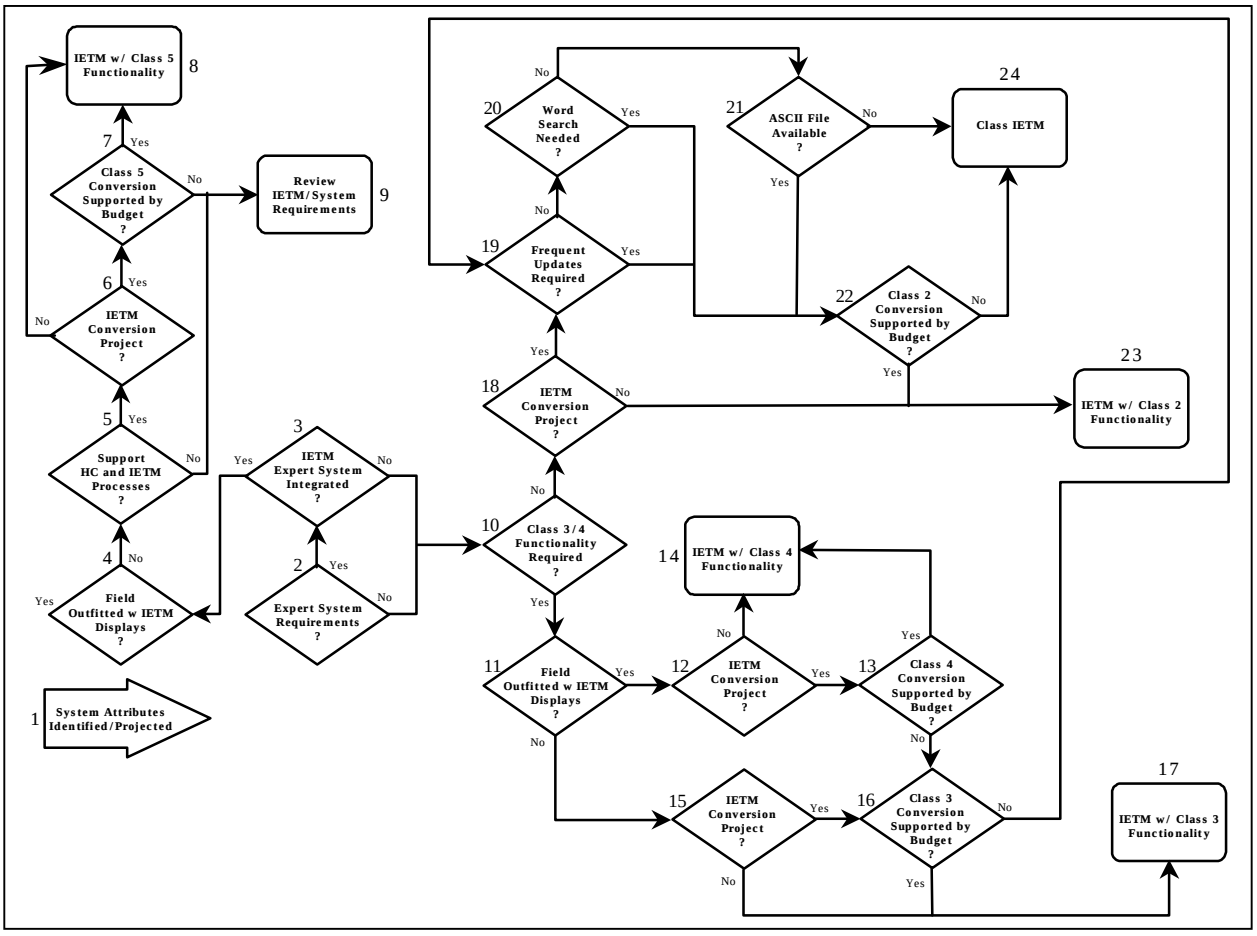

Figure 5-2. IETM Functionality Determination Model

- The IETM CONOPS will provide program personnel and bidders with a broad perspective of the range of factors and issues affecting their proposed IETM solution. The Government also

will use the CONOPS to evaluate how well a bidder has understood and met the program's IETM needs. Development may be iterative. New conditions such as budget reductions, program phasing, emerging technologies and evolving functionality requirements may necessitate a review of the CONOPS and a reevaluation of some or all decisions.

- Finally, a key benefit of developing a CONOPS is that change is discussed as a part of the IETM development process. Factors critical to IETM success are highlighted in the CONOPS and monitored so that changes which impact IETMs can be quickly noted. This helps to ensure that a proposed solution is not overtaken or overwhelmed by events or technology. Decision processes are revisited and parameters adjusted, if necessary, to ensure continued success.

Instructions for Figure 5-2

Step 1: The program identifies or projects the attributes of the system or equipment as they relate to the IETM, as the first step in developing the IETM CONOPS.

Step 2: Does the user require an expert system? Expert systems capture and broadly share technical support, where minimal levels of technical support may be available. They provide the user with subject matter expertise that expands user levels of knowledge and detail, augments skills, and improves diagnostic and maintenance procedure accomplishment for complex systems. Training and foreign military support requirements should also be considered when evaluating expert system requirements. The following lists some examples of system characteristics that may require the use of expert systems:

- In a new design where the diagnostics and processes are clearly laid-out and ready for incorporation with an expert system.
- A highly complex system with complex troubleshooting or fault isolation procedures. The expert system keeps track of what has been done, what is next, other possibilities, etc.
- Critical systems needing reduced time from diagnostics to repair (e.g., flight line download and processing, online sensors connected to the expert system).
- Reduced maintenance cost from higher-quality repair, reduced false return rates, "smarter" maintenance from system "learning," more concise and accurate parts orders.
- Systems requiring supplemental training of all types.

Step 3: Is the IETM and/or the expert system to be integrated into the weapon system? Some systems have the operating systems available that can support the processing of IETM viewing software. This efficient use of computer processing capability minimizes the computer components required to support the IETM. Is it intended that the expert system be embedded within the IETM. If so, this may present additional hardware,

software, and interface requirements. If integration of the IETM and/or expert system with the weapon system or embedding of the expert system within the IETM is not a requirement, Class V functionality can be achieved through an independent system interface. If the IETM does not need to be integrated, it can have a linearly structured database as found in Class I-III IETMs, which allows the entire TM to be printed for field and other users until all are outfitted with display hardware. The IETM display infrastructure must also consider any potential training and foreign military display support requirements.

Step 4: Is the user outfitted with display hardware; are the display hardware maintenance processes in place to support these displays?

Step 5: If the user is not otfitted, or has no current plans to be outfitted, with the IETM display hardware needed, the program may adopt a less capable strategy that allows for continued production of hard-copy (HC) TMs.

Step 6: Is the IETM application a new acquisition or conversion of existing legacy TMs?

Step 7: The costs for conversion to Class I and II IETMs are fairly well understood because of each Service's TM digitization efforts, while the cost of conversion to the higher-level Classes is still evolving. Management decisions on the granularity and level of indenture needed, will also significantly impact these costs. The Program Manager must decide whether the relatively high conversion costs for Class IV and V IETMs are offset by improvements in task performance and savings achieved in maintaining the database.

In addition to the system or equipment attributes discussed above, the following factors should be considered or emphasized:

- Periodicity of updates - More frequent updates will result in substantially more savings (cost avoidance) as compared with other IETM update processes.

- Configuration volatility – Object-oriented databases are very efficient in managing data in support of multiple configurations of complex systems. For fairly static systems, the advantages are less significant.

- Quantity of legacy data involved in support of the system - If a large amount of legacy data exists (e.g., greater than 500 pages), there is typically a lot of repeated data (e.g., WARNINGs, CAUTIONs, NOTEs, procedures, descriptions). Redundant data can also be significantly reduced with re-authoring. An object-oriented database provides the most efficient method to store, maintain, update and use this data.

- Cost reduction – With new IETM authoring tools being implemented in applications that require a significant reuse of data, it has been proven that IETM changes can be produced at 50 percent of the cost incurred in producing hard-copy changes using traditional publishing processes.

- Maturation – Object-oriented database strategy planning is a new field, with only a limited number of applications. There are still only a few Class IV and V IETM tools currently available commercially.

Step 8: Create an IETM with Class V functionality.

Step 9: If a Class V conversion is not cost effective when considering its benefits over the life-cycle, then the program must reevaluate the IETM/system requirements and optimize them to meet budgeting requirements. Programs should also consider implementing IETMs in a phased approach, which helps lower cost impacts over time.

Step 10: Do the contents of the manual(s) and the attributes of the hardware system support Class III and IV functionality? Several factors need to be considered to determine whether Class III or IV functionality is the most cost effective in support of the system. The following factors should be considered:

- quality of the data
- complexity of the system/equipment
- conversion costs
- system maintenance levels
- configuration volatility
- manning requirements
- training levels
- contractor and Government infrastructure

Step 11: Are there plans to deploy the IETM in the field? In particular, if the IETM is to be Class IV (object database), "print screen" may be the only printing option. As all data will be conveyed via the display hardware, it is imperative that the field will have the appropriate display hardware and the support processes needed to maintain the IETM and IETM hardware in place. The IETM display infrastructure must consider any potential training and Foreign Military display support needs.

Step 12: Is the IETM application a new acquisition or a conversion of existing legacy TMs?

Step 13: Using the factors in Step 10, determine the costs and benefits of Class III and IV IETMs, and whether the budget will support a Class IV IETM conversion process.

Step 14: If program budgets support the conversion effort, convert the legacy data into a Class IV IETM by creating an hierarchical structure within an object-oriented DBMS using MIL-PRF-87269.

Step 15: Is the IETM application a new acquisition or a conversion of existing legacy TMs?

Step 16: If a Class IV functionality is not required, conversion is not cost effective, or the field will not be outfitted with display hardware in an appropriate time, then the program should determine whether converting legacy TMs into an IETM having Class III functionality is cost effective and affordable. The primary element of Class III IETMs is the use of view packages. They can emphasize specific subject matter content within the IETM and then present the user with only data pertaining to the subject controlled by the view package. An IETM can have several view packages,

each emphasizing a different subject (e.g., operator training, overhaul procedures, system overview). The user might also be able to select view packages for novice, intermediate, and expert levels -- each presenting or emphasizing the data differently.

Step 17: If view packages are needed and affordable, convert the legacy TM into a Class III IETM.

Step 18: Is the IETM application a new acquisition or conversion of existing legacy TMs? If it is a new acquisition, the minimum functionality that should be procured is Class II.

Step 19: Determine if frequent updates to the TM are required. If so, an IETM having Class II functionality is preferred over Class I.

Step 20: Determine whether the ability to perform "word searches" would significantly benefit the user. This benefit must be weighed against the cost to convert the hard-copy into ASCII or other neutral format such as PDF, plus the cost of proofing the resultant file to ensure that it accurately represents the hard-copy. If it is determined to be cost effective, an IETM having Class II functionality is preferred.

Step 21: If a digital file of the legacy TM is available, the program should convert the legacy data into an IETM having Class II functionality. The cost to convert existing digital files into IETMs having Class II functionality is well worth the expense, by being able to use an automated publishing system to update information, as well as giving better navigational features (word searches, links, etc.) to the user. Note that each of the Services has already completed major TM digitization efforts that have resulted in either Class II IETMs or files easily convertible to Class II.

Step 22: If Class II IETM cost of conversion can be supported, convert the data into an IETM having Class II functionality.

Step 23: Convert the legacy data into, or acquire the IETM having Class II IETM functionality.

Step 24: If Class II IETM cost of conversion cannot be supported, convert the legacy TM into a Class I IETM.

5.9 Inclusion in the Statement of Work/Objectives (SOW/SOO)

The information presented in the CONOPS is not intended to be exhaustive. But it should include the primary management considerations when deciding a program's optimal IETM level. Whether an IETM is being acquired as part of a new hardware system or being converted under contract, the resulting CONOPS will be referenced in the SOW/SOO -- along with the environment within which the IETM will be developed, fielded, and used. Additionally, the CONOPS should indicate other information that helps bidders propose their systems and, in addition, helps the program staff evaluate the responses to the required and desired functionality requirements. Do not substitute detailed descriptions and/or "laundry lists" of highly desirable or mandatory features for firm requirements. This may restrict all bidders to a solution that may or

may not be optimal, or that unnecessarily drives up the cost of the proposed solution. Where the program has decided on specific features, functionality, or characteristics that are required to support various aspects of the system, they should be reflected in the SOW/SOO and Technical Manual Contract Requirements (TMCR).

5.10 CONOPS Development

Development of the CONOPS involves analysis of the hardware or weapon system being supported. It also involves determination of the functionality required by the users of the system, and consideration of a variety of other factors that will be documented in separate paragraphs of the CONOPS. The following paragraphs suggest a sequence in which applicable subjects are covered in the CONOPS, and they describe what those paragraphs need to contain. Other paragraphs or information that are deemed relevant to the common understanding of the system and its operating environment, the IETM and its operating environment, and/or any unique conditions may be added. Use the outline below as a guide to develop your CONOPS.

1. Weapon System/Equipment Attributes and Factors Influencing or Dictating Functionality
2. IETM Functionality Determination
3. IETM Implementation Schedule
4. Urgency and Frequency of Information Update
5. DTDs and FOSIs
6. Graphics
7. Links to Other Information Resources
8. Security
9. IETM Licenses
10. Development of IETM View Package Requirements
11. Technical Manual Identification Number
12. Deficiency Reporting Process
13. Media Identification Labels
14. Building CD-ROM Deliverables
15. Display Hardware, Operating Systems and Networks
16. Environmental Conditionals and IETM Display Hardware
17. Display Hardware, and Software Maintenance and Support